(12) UK Patent Application (19) GB (11) 2 032 308 A

(21) Application No 7841086
(22) Date of filing 18 Oct 1978
(23) Claims filed 18 Oct 1978
16 Oct 1979
(43) Application published
8 May 1980
(51) INT CL³
B21D 5/04
(52) Domestic classification
B3E 10A15 14G 1E1 1EX
1Y CF
(56) Documents cited
1223880
951895
683582
662279
626805
(58) Field of search
B3E
(71) Applicants
James Dennis Folwell,
24 Trevor Road,
Northampton,
NN5 5PF.
(72) Inventors
James Dennis Folwell
(74) Agents
A.A. Thornton & Co.

(54) Sheet metal folding machine

(57) In an apparatus for folding sheet metal, comprising a bed 20 for supporting a sheet metal workpiece with the workpiece projecting over the front edge of the bed, a clamping beam 16 pivotable about a horizontal axis for clamping the workpiece to the bed, and a folding beam 26,36,38 normally hanging downwards along the front of the bed as shown and pivotable upwards about an axis A for the top edge of a metal block 38 to fold the workpiece, the bed is capable of lowering relative to axis A. A front portion of the clamping beam is removable and replaceable by a cylindrical mandrel having its axis in the vertical plane containing A and if the bed and clamping beam are then lowered until the mandrel axis coincides with A, and the folding beam is adjusted to lower the effective top edge of block 38 appropriately, then accurate radii can be folded in the workpiece around the mandrel. Stepped blocks 36 are secured at selected positions along a rebate 34 in beam 26 and rectagular blocks 38 may be cut from appropriate thickness for particular jobs.

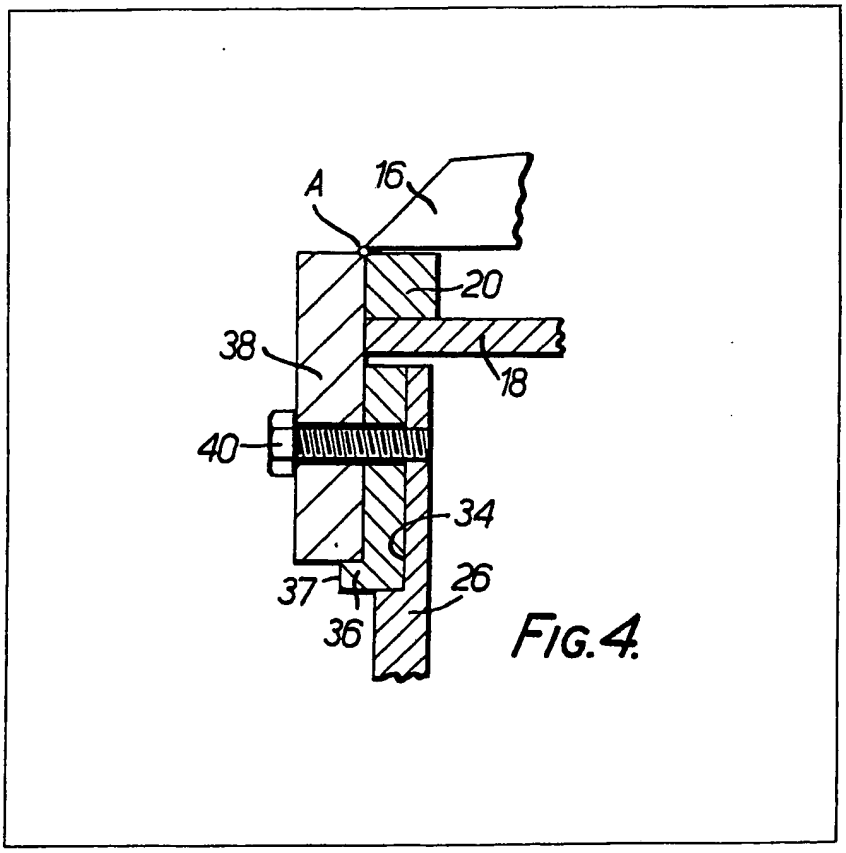

FIG.4.

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

GB 2 032 308 A

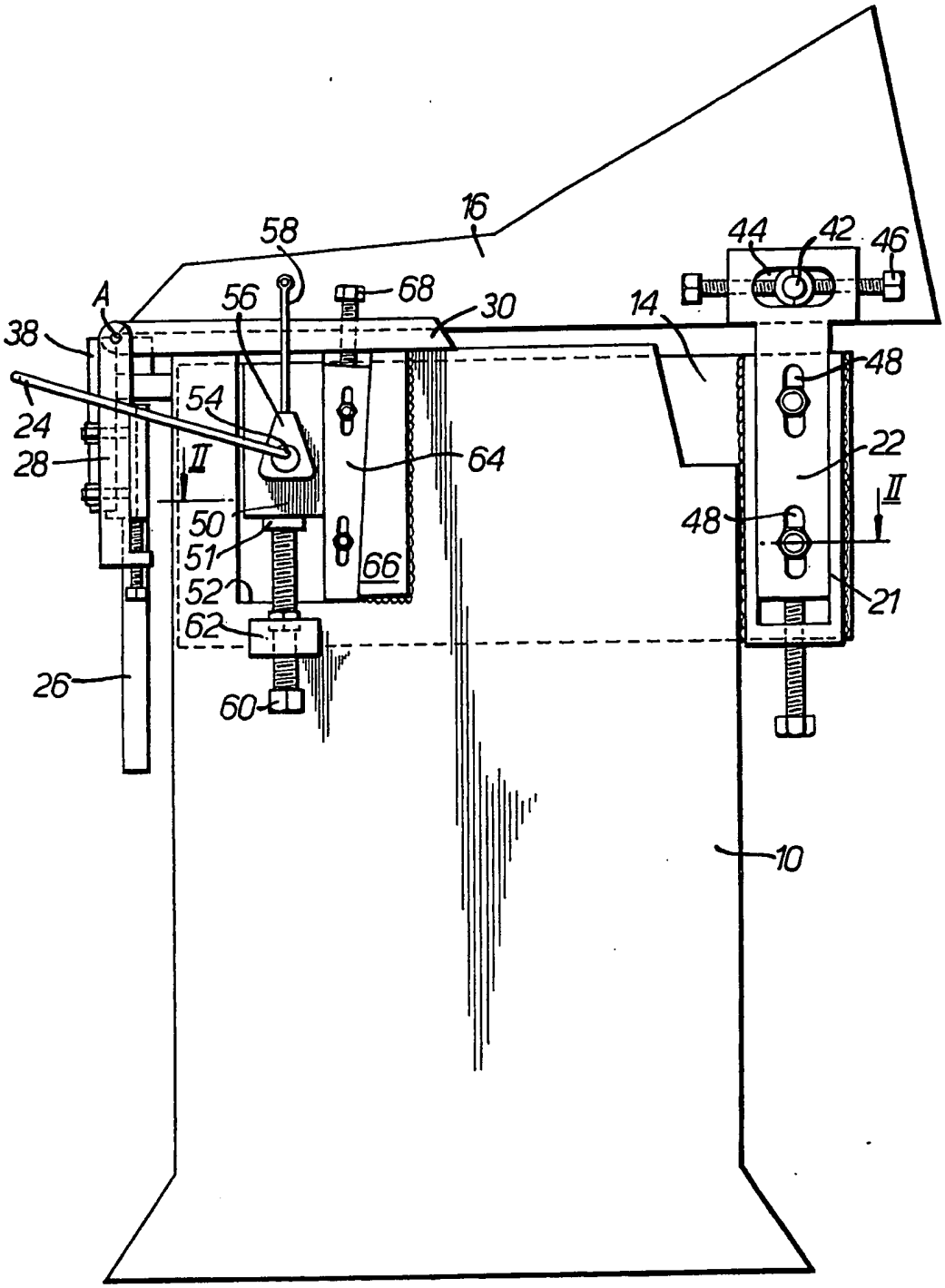
16
58
44
42
46
A
56
68
30
14
38
48
54
24
64
22
28
II
II
50
48
51
66
52
21
62
26
60
10

FIG.1.

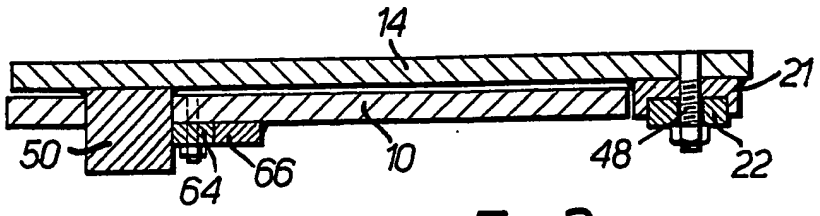

FIG.2.

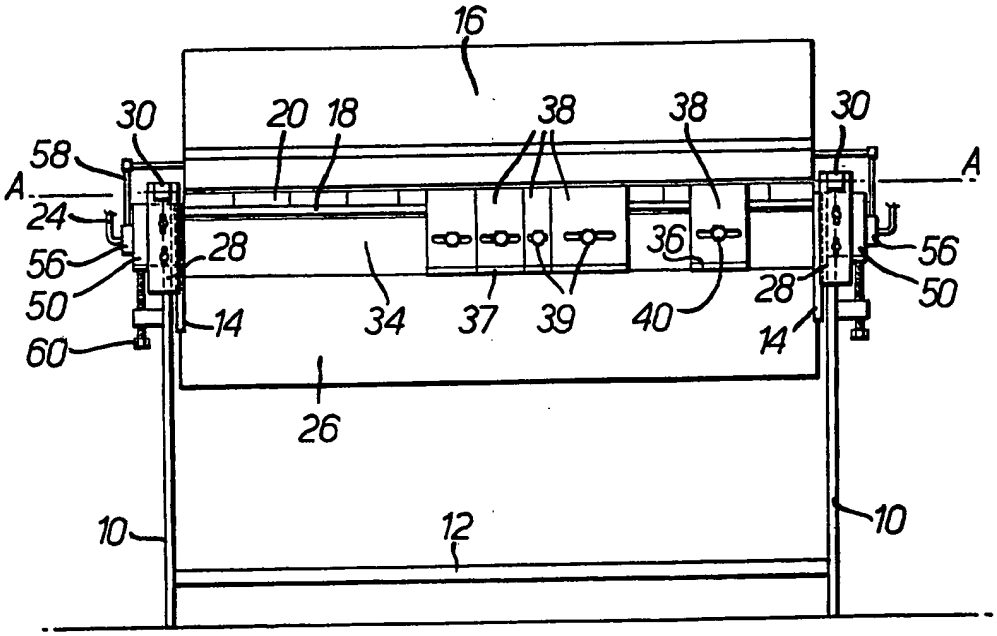

FIG.3.

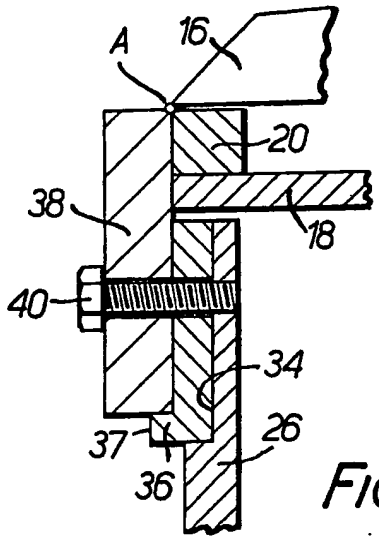

FIG.4.

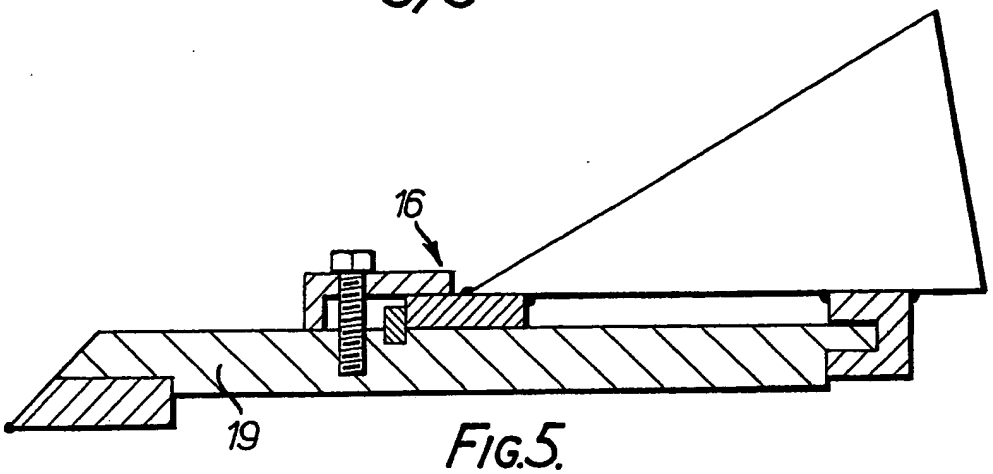

FIG.5.

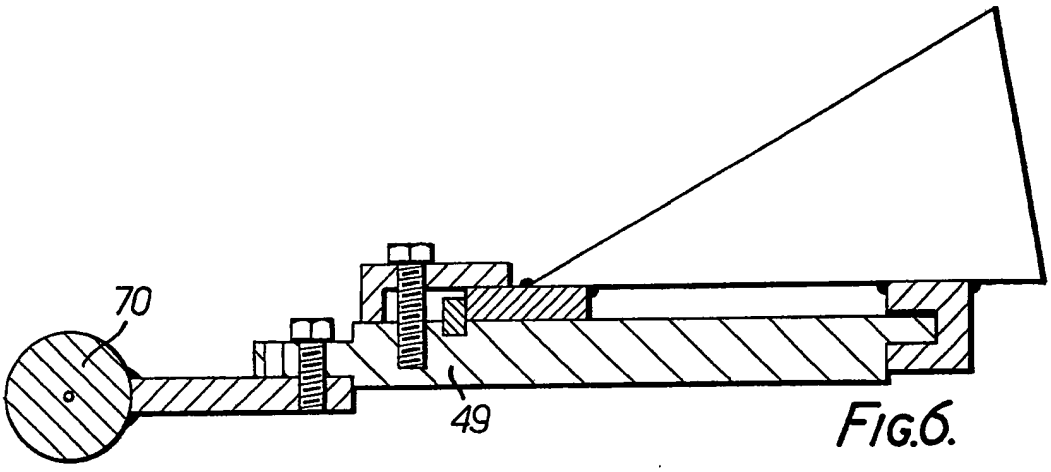

FIG.6.

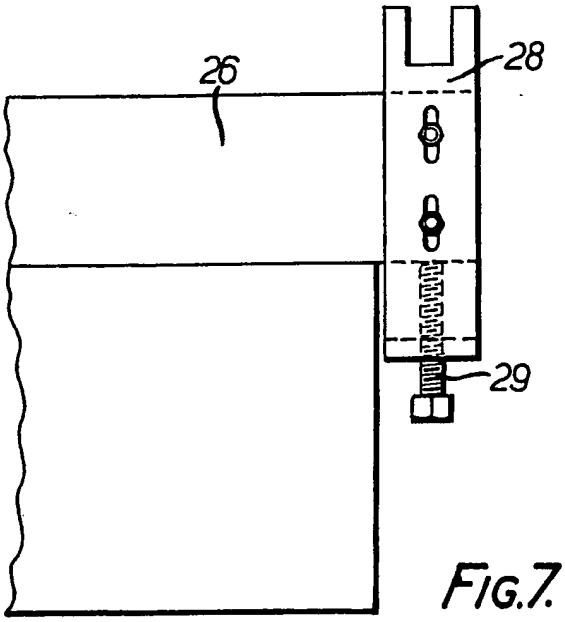

FIG.7.

SPECIFICATION

Sheet metal folding machine

This invention relates to a machine for folding sheet metal.

Machines for folding sheet metal are known in which a workpiece to be folded is clamped to a horizontal bed by a clamping beam which is provided with removable clamping fingers side-by-side along its length and which is pivotable about a horizontal axis to the rear of the bed to raise and lower the clamping beam to clamp the workpiece to the bed. A folding beam is provided normally hanging downwards but pivotable upwards about an axis coincident with the front, top edge of the bed and front, bottom edge of the clamping beam. The folding beam includes an upper edge formation co-planar with the upper surface of the bed and forming a forwards extension thereof. Upon pivoting the folding beam upwards, this upper edge portion bears on the clamped workpiece to fold the latter about a line coincident with the axis of pivoting the folding beam.

Although this known machine operates satisfactorily, its versatility is limited. The present invention provides a machine of much greater versatility.

An embodiment of this invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is an end view of a sheet metal folding machine;

Figure 2 is a section on line II-II of Figure 1 through one end of the machine;

Figure 3 is a front view of the same machine on a smaller scale, with certain of the details at both ends of the machine omitted for clarity;

Figure 4 is a section through a front portion of the machine set for a normal folding operation;

Figure 5 is a section through a clamping beam of the machine set for a normal folding operation;

Figure 6 is a single section when the machine is set for forming a radius fold in a workpiece; and

Figure 7 is a front view of an end of a folding beam of the machine.

Referring to Figures 1-3 of the drawings, a machine for folding sheet metal comprises a fixed metal main frame standing on the floor of a workshop, this main frame comprising two vertical end panels 10 and interconnecting metal bracing members, one of which is shown at 12. Metal slide plates 14 are disposed on the inner sides of the end panels 10 and are movable vertically, as will be described below, for vertical movement of the bed of the machine and also for vertical movement of a metal clamping beam 16 of the machine.

The bed (Figures 3 and 4) comprises a metal deck portion 18 rigidly secured at its opposite ends to the slide plates 14, and a raised portion 20 along the front of the deck portion. The clamping beam is provided with a plurality of removable fingers 19 side-by-side along its length and is pivoted at its opposite ends to metal brackets 22 which are fitted to vertical slide members 21 welded to portions of slide plates 14 which project rearwardly of the end panels 10 (see Figures 1 and 5). A lever 24 is provided for operating, through an eccentric mechanism, to pivot the clamping beam to raise and lower it relative to the bed, for clamping a sheet metal workpiece to the upper surface of the raised portion 20 of the bed.

A metal folding beam 26 is pivoted, by way of arms 28 at its opposite ends, to arms 30 which are secured to and project forwardly from the end panels 10 at the top thereof. The folding beam is adjustable vertically in the pivot arms 30 in that the arms 28 are bolted to the beam 26 through vertically elongated slots in the arms 28 (Figure 7), a bolt 29 being threaded in a lower end of each arm 28 to support the beam 26. Normally, the beam 26 hangs downwards, with its top edge immediately below the underside of the bed deck portion 18 (Figure 4) and with the plane of its front surface spaced rearwardly (by say $\frac{1}{4}$ inch - 6.4 mm) of its axis A-A of pivoting, in accordance with my patent application 34953/76. An arm (not shown) is provided for pivoting the folding beam 26 upwards to a generally horizontal position, and is provided with adjustable counter-balance weights. Further in accordance with my patent application 34953/76, metal blocks are secured to the folding beam at selected positions along its length and are themselves effective in folding the sheet metal workpiece when clamped to the bed. Thus (Figures 3 and 4), a rebate 34 is formed in the front surface of the folding beam 26 at its upper edge and threaded bolt holes are formed in the rebate, regularly spaced along its length. A number of rectangular metal blocks 36 are provided, each having a height equal to the width of the rebate and an integral rectangular section projecting rib 37 along its front surface at the bottom edge thereof. The thickness of each block 36 is greater than the depth of the rebate by an amount equal to the rearward spacing of the front of beam 26 behind the vertical plane containing axis A-A. A number of rectangular metal blocks 38 are also provided and both blocks 36 and 38 are formed with horizontal slots 39 so that fixing bolts 40 may be passed through each block 38 and a corresponding block 36, when they are mated as shown, into respectives ones of the threaded bolt holes which are formed in the rebate. In the bolted-on position shown, the bottom edge of block 36 seats on the side of the rebate, with its top edge co-planar with the top edge of the beam 26 and its front major surface co-planar with the vertical plane containing the axis A-A. The block 38 seats with its bottom edge on the rib 37 and projects above the top edge of the beam 26 by an amount equal to the thickness of the bed at its front edge.

The blocks 36 and 38 preferably correspond to each other in width (i.e. their dimension lengthwise of the beam 26), but this width may vary so that blocks of different widths can be selected for different jobs. The blocks may be secured to the folding beam 26 at selected positions along the beam. The thickness of the blocks 38 may be selected according to the job to be performed and indeed these blocks may be cut to appropriate size from metal of appropriate thickness for any special jobs.

The folding beam 26 may be adjusted relative to its pivot arms 28 so that the top edge of the blocks 38 are co-planar with the top surface of the bed and so that the top, rear edges of the blocks 38 are coincident with the top, front edge of the bed on the axis of pivoting of the folding beam 26. With a workpiece clamped by the clamping beam to the bed, then upon pivoting the folding beam to its horizontal position, the top edges of the blocks 38 will be effective to fold the workpiece through 90° about the front, bottom edge of the clamping beam (which is adjusted to be also coincident with the axis of pivoting the folding beam). In this operation, the folding beam itself is not effective to fold the workpiece, so that the folding action does not take place discontinuously along the length of the bed, but only in correspondence to the positions at which blocks 36, 38 are secured.

It will be noted that the raised portion of the bed comprises a plurality of rectangular-section metal bars removably bolted to the deck portion of the bed. Any one or more of these bars may be removed if a workpiece to be folded is such that it must be placed on the bed with a portion projecting downwardly so as to otherwise interfere with the raised portion of the bed. Metal bars of appropriate length and width may be secured to the bed for special jobs.

Front-to-back adjustment of the clamping beam is available in that pivot pins 42 projecting from the clamping beam are received within horizontally elongated slots 44 in the tops of the brackets 22, opposed bolts 46 being threaded through the brackets to bear on the pivot pins at diametrically opposite positions. Thus, the bolts 46 are adjustable to alter the positions of the pivot pins 42 relative to the brackets 22, in the horizontal plane back-to-front of the machine.

Vertical adjustment of the pivot axis of the clamping beam is available, relative to the horizontal plane of the top of the bed, in that the brackets 22 are bolted to the slide plates 14 by bolts which extend through vertically elongated slots 48 in the brackets 22. This vertical adjustment has advantage when tooling of different thicknesses is secured to the clamping beam, to ensure that, with a greater thickness of tooling, the pivot axis of the clamping beam can be raised so that the workpiece is still clamped by the front edge of the clamping beam. Such tooling is applied by replacing one or more of the clamping fingers by adapter bars 49, to the front edges of which downwardly projecting toolings are bolted, for folding a workpiece which must be placed on the bed with a portion thereof projecting upwardly rearwardly of the front edge of the bed (and thus accommodated behind this tooling).

Each slide plate 14 is provided with a projection 50 extending through an aperture 52 in the corresponding end panel 10. In the outer end of this projection is journalled an eccentric bearing 54 to which lever 24 is secured and on which a cam 56 is carried. Upon rotation of the lever 24, the cam 56 is moved upwards or downwards to lift or lower the clamping beam, the cam 56 being connected to the clamping beam by an arm 58.

Each slide plate 14 and its end panel 10 are complementarily formed so that the slide plate is constrained to vertical sliding movement relative to its end panel. A bolt 60 is threaded in a nut resting in a recess of a projection 62 of the end panel and projects upwards to bear against the lower side of the projection 50 of the slide plate, through a thrust race 51, to support the slide plate against downwards movement. Upwards movement of the slide plate is effected by tightening the bolt 60. The slide plate is then locked in position by a wedge 64 which is bolted to the end panel 10 through inclined, elongated slots as shown: on one, vertical side this wedge bears against a vertical surface of the projection 50 and on its other, inclined surface the wedge bears against an inclined surface of a wedge 66 which is welded to the end panel 10. A bolt 68 extends through the arm 30 to bear on the top of wedge 64 to wedge it against the projection 50. In order to lower the slide plate, the wedge 64 is freed, the bolt 60 is loosened appropriately and then the wedge is secured again.

A particular advantage of the vertical adjustment, afforded by the slide plates 14, of the bed and clamping beam relative to the folding beam, lies in enabling the formation of an accurate radius on a workpiece. Thus, a mandrel 70 (Figure 6) of the required radius is secured to the front edge of the clamping beam, with the axis of the mandrel in the vertical plane of the axis A-A of pivoting the folding beam. The mandrel is provided with laterally projecting lugs for bolting to the adapter bars of clamping beam when these have replaced the usual fingers 19. The bed and clamping beam must next be lowered, by movement of the slide plates 14, until the axis of the mandrel co-incides with the axis of pivoting the folding beam: also the folding beam 26 must be lowered relative to its pivot arms 28 until the top surface of blocks 38 is co-planar with the top surface of raised portion 20 of the bed. Then, upon clamping a workpiece between mandrel and bed and pivoting the folding beam upwards, the top edge of the blocks 38 executes a true radius about the mandrel and curves the workpiece in a true radius about the mandrel. Advantageously, the clamping beam may be retracted horizontally by adjustment of its pivot bolts 46 to set the mandrel axis slightly rearwards of the vertical plane of the pivot axis A-A to maintain a good clamping action on the workpiece.

CLAIMS

1. An apparatus for folding sheet metal, comprising a bed for supporting a sheet metal workpiece to be folded, with the workpiece projecting over a front edge of the bed, a clamping beam pivotable about a horizontal axis for clamping said workpiece to the bed, and folding beam extending along the front of the bed, the folding beam being pivotable upwards about a horizontal axis from which it normally hangs downwards in order to fold the workpiece along the front edge of the bed, and the bed being capable of lowering relative to the horizontal axis of pivoting of the folding beam.

2. An apparatus as claimed in claim 1, comprising a fixed frame having two opposite end panels,

and two slide plates mounted to respective end panels for vertical adjustment with respect to the end panels, the bed being secured at its opposite ends to the slide plates.

3. An apparatus as claimed in claim 2, comprising an adjustable bolt acting between each end panel and the respective slide plate, for vertical adjustment of the slide plate.

4. An apparatus as claimed in claim 2 or 3, comprising means for locking the slide plates in the vertical positions to which they are adjusted.

5. An apparatus as claimed in any preceding claim, in which the folding beam is adjustable for lowering an effective upper edge thereof relative to its horizontal axis of pivoting.

6. An apparatus as claimed in any preceding claim, in which one or more metal blocks may be mounted at selected positions along the beam so that, upon pivoting the beam upwards, each block is effective over its own length to fold a workpiece supported on the bed.

7. An apparatus as claimed in claim 6, in which the folding beam is provided with a rebate in its front surface adjacent its top edge, in which rebate said blocks may be located.

8. An apparatus as claimed in claim 7, in which the blocks comprise a first block for location in the rebate and having a step on a front surface adjacent a bottom edge, and a second block of rectangular section for locating on the front surface of said first block against said step.

9. An apparatus as claimed in claim 7 or 8, in which the blocks are formed with apertures aligned with threaded bores in said rebate, for receiving bolts securing the blocks to the folding beam.

10. An apparatus as claimed in any preceding claim, in which the front edge of the bed comprises a plurality of removable sections along its length.

11. An apparatus as claimed in any preceding claim, in which the horizontal axis of pivoting of the clamping beam is adjustabie vertically relative to the bed.

12. An apparatus as claimed in claim 11, in which the horizontal axis of pivoting of the clamping beam is adjustable forwards and backwards relative to the bed.

13. An apparatus as claimed in claim 11 or 12 appended to claim 2, 3 or 4, in which the clamping beam is adjustably pivotally mounted to said slide plates.

14. An apparatus as claimed in any preceding claim, in which the clamping beam comprises a front, effective clamping portion, at least part of which is removable.

15. An apparatus as claimed in claim 14, in which said front portion of the clamping beam comprises a plurality of individual sections independently removable.

16. An apparatus as claimed in claim 14 or 15, further comprising a cylindrical mandrel for securing to the clamping beam in place of the removable part of the front portion, with the axis of the mandrel in the vertical plane which contains the axis of pivoting the folding beam.

17. An apparatus for folding sheet metal, comprising a bed for supporting a metal workpiece to be folded, with the workpiece projecting over a front edge of the bed, a clamping beam for clamping said workpiece to the bed, a folding beam extending along the front of the bed, the folding beam being pivotable upwards about a horizontal axis from which it normally hangs downwards and being formed with a rebate in its front surface adjacent its top edge, and one or more metal blocks capable of being mounted at selected positions along the folding beam in said rebate with a step on one surface of each of those blocks facing forwards and positioned adjacent the lower edge of that block, and a further rectangular section metal block for each of the first-mentioned blocks, each further block being capable of mounting on the front surface of the respective first-mentioned block with its lower edge against said step and with its upper edge effective over its own length to fold the workpiece along the front edge of the bed upon pivoting the folding beam upwards.

18. An apparatus for folding sheet metal, substantially as herein described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office by Croydon Printing Company Limited, Croydon Surrey, 1980.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.